

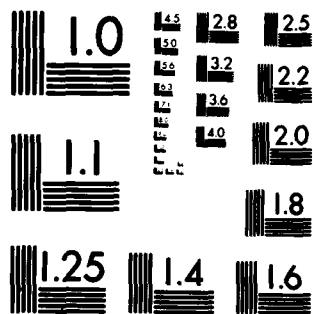
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COMBINATORIAL ALGORITHMS IN OPERATIONS RESEARCH

FINAL REPORT

T. C. HU

MARCH 10, 1980

U.S. ARMY RESEARCH OFFICE

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20. ABSTRACT (Continue on reverse side if necessary and identify by block number) ➤ Nine technical papers and a manuscript of a book on "Combinatorial Algorithms" were prepared during this period. ➤ The most significant discoveries are two algorithms of constructing binary tree optimum under various criteria. The first algorithm constructs optimum binary trees which include Huffman's tree as a special case. The second algorithm constructs optimum alphabetic trees which include Hu-Tucker tree as a special case. ✕		

Foreword

The most important combinatorial algorithm in operations research is the Simplex Method. In fact, the different extensions of the Simplex Method and related later developments become the body of knowledge known as mathematical programming. Some standard reference books in mathematical programming are, "Linear Programming and Its Extensions" by Dantzig, "Flows in Networks" by Ford and Fulkerson, and "Integer Programming and Network Flows" by T. C. Hu.

However, many combinatorial algorithms are not related to the Simplex Method and they are widely used in operations research. For example, the back-track method (or branch-and-bound), the dynamic-programming-type algorithm, and various heuristic algorithms can all be classified under this category. The principal investigator has developed several such algorithms and prepared a book on combinatorial algorithms during the grant period.

Report

Nine technical papers [1-9] were prepared during the period. Following are some of the highlights of our work.

A well-known heuristic algorithm to solve a knapsack problem is called the greedy algorithm. Essentially, the algorithm puts into the knapsack, as many as possible, the most valuable items; then the second-most valuable items into the remaining space, etc. Magazine, Nemhauser and Trotter characterized the necessary and sufficient conditions for such a heuristic algorithm to work. He and Lenard [2] gave a simple proof. Hu and Tien [6] obtained the maximum error bound of the heuristic algorithm when it fails to give the optimum solution.

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